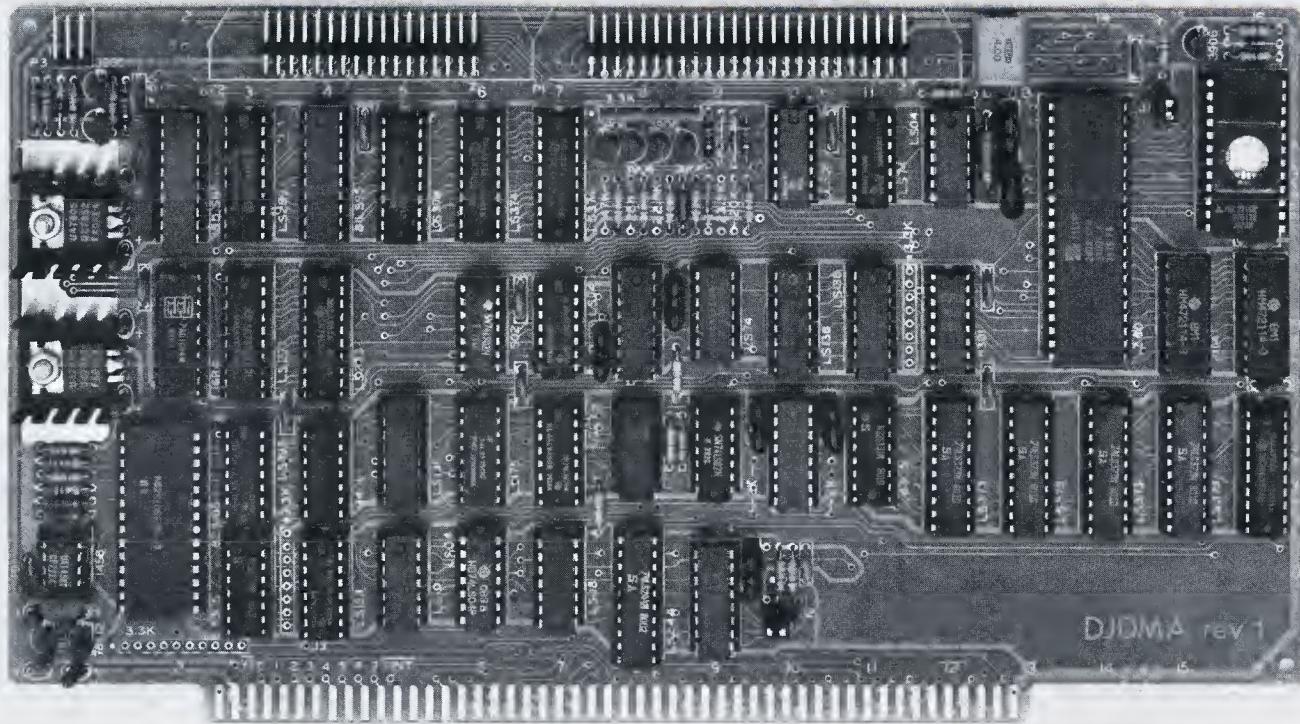


# Disk Jockey® DMA Floppy Controller



The DISK JOCKEY® DMA FLOPPY DISK CONTROLLER (DJ/DMA) is an IEEE 696 (S-100) compatible floppy disk controller which contains logic to implement Direct Memory Access (DMA) operations on the S-100 bus.

This is a floppy disk controller S-100 users have dreamed about. Let us show you why.

## Features

- Single S-100 board
  - Full DMA IEEE-696 implementation
  - On board Z80A microprocessor supervises operations of the controller.
  - Supports IBM compatible soft-sectorized 8" diskettes and North Star compatible hard sectorized 5½" diskettes
  - Optional enhancements to read and write 5½" soft sector diskettes (IBM, Radio Shack, etc. will be available in the spring of 1982)
  - Handles (4) 5½" drives or (4) 8" drives simultaneously
  - Variable sector lengths (128,256,512,1024 byte)
  - Automatic double and single sided drives
  - Handles 48 and 96 track per inch drives
  - Channel driven commands allow sequencing, branching and loops
  - All disk driver routines(except formatting) resident on the controller board
  - No sector buffering required

## Speed

The speed of this controller is enhanced by our channel drive concept. The DJ/DMA picks its commands from the host processor via memory on the system bus. The host processor writes commands into memory and the DJ/DMA picks them up during DMA cycles from this memory. The channel commands and transfers may be located anywhere in the 24-bit address range. At the completion of the command, the controller returns appropriate status and can generate an interrupt. Commands may be chained together by the CPU to allow the controller to execute many commands in succession, generating an interrupt at the end of each command and/or at the end of the completed command chain. It acts as a temporary bus master and has priority arbitration logic to allow other IEEE/696 compatible temporary masters to contend for bus cycles. The DJ/DMA generates interrupts via the V10\* - V17\* vectored interrupt lines or by driving the PINT\* directly. The controller is sent commands through memory and acts almost identical to the channel controllers which attach to the IBM®/370 main frames. The controller recognizes a wide variety of commands which may be chained together. Completion status words are embedded in the commands and the DJ/DMA fills them in as it completes individual commands within a chain.

There is a Z-80A microcomputer resident on the controller which is used both in memory transfers and disk transfers. The controller contains state of the art logic which allows it to read and write almost any type of floppy disk media be it 8" or 5 $\frac{1}{4}$ ". Up to 8 drives may be attached to the controller, the only restriction being that no more than 4 of each type can be accommodated.

The DJ/DMA can read and write both single and double density media and can determine automatically which media is present. Sector sizes can be 128, 256, 512, or 1024 bytes to accommodate the data organization requirements of almost any operating system.

## **Specifications and Description**

## **Temporary Bus Master Specifications**

- TPA device number is \* (0-F as per the proposed IEEE/696 standard)
  - Arbitration logic allows bus contention when other IEEE/696 compatible temporary masters are present on the bus
  - Full 24 bits of addressing are implemented
  - IEEE/696 Error\* line may be activated for fast error response
  - Capable of memory read, memory write, I/O read, and I/O write bus operations

Specifications, prices, terms subject to change without notice.

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# MORROW DESIGNS



# Disk Jockey® DMA Floppy Controller

- Capable of both cycle steal mode of transfers along with bus hog transfer mode
- Full overlap of bus command/control lines as per IEEE/696 specifications for glitch free DMA cycle operations
- Compatible with both older style S-100 equipment and newer IEEE/696 standard machines
- Completely independent of the permanent master CPU. Will transfer data reliably with bus clocks running as fast as 15 MHZ. Hence the DJ/DMA will work with the new breed of 8 and 16 bit micro processors which will be available on the S-100 bus within the next few years
- Data transfers may cross 64 K boundaries

## Channel Command Specifications

The controller is started by issuing any output instruction to port EF (the other addresses are available by special order - see price list for special I/O addresses).

After receiving the start channel command via the I/O write, the controller begins executing commands which start at 50 H. (other starting addresses are available by special order). The controller will continue executing channel commands until a halt instruction is encountered or an illegal instruction is encountered at which time the channel command word address is reset and the controller waits for another start channel command.

Channel commands presently implemented are as follows:

read (track, sector/side, drive)  
write (track, sector/side, drive)

Legal track values will range from 0 to 255 (decimals) depending on the type of drive attached to the controller. The controller can accomodate both double sided drives and/or double track density drives. Legal sector values range from 0 to 26 depending on the sector size, and whether the media is soft or hard sectored. The media formats presently recognizable by the controller are IBM compatible 8" media, and North Star compatible 5 1/4" Hard sectored media. Other media formats will be offered in the future and controllers in the field may be upgraded by exchanging the on-board EPROM firmware at a modest cost. Legal drive numbers range between 0 and 7. Drives 0 to 3 are 8" and 4 to 7 are 5 1/4" unless changed by the operating system software.

## Sense Status (drive)

This command returns three bytes which

describes in detail the type of drive attached to the controller as well as the type of media present in the drive.

set DMA address (1sb, msb, epb)  
1sb = least significant byte  
msb = most significant byte  
epb = extended page

## Generate interrupt

This command causes the controller to assert the interrupt request line. It will hold the line active until the next start channel command is issued.

## Controller halt

branch in channel (1sb, msb, spb).  
set channel command word address (1sb, msb, epb)  
set CRC error retry count (count)  
read track (track, side, drive)  
write track (track, side, drive, 1sb, msb, epb)  
1sb = least significant byte of dirty sector list  
msb = most significant byte of dirty sector list  
epb = extended page byte of dirty sector list

There are several other diagnostic commands which will not be supported in the field. If any command other than above is issued to the controller, the results will be unpredictable and perhaps disastrous to media present in a drive which is not write protected.

## Hardware Specifications

- On-board Z80A micro processor @ 4 MHZ
- 4K bytes of EPROM
- 1K bytes of RAM
- On-board RS232 serial port (diagnostics only)
- Programmable bipolar LSI logic implements disk read/write operations
- 50 pin connector for 8" drive, 34 pin connector for 5 1/4" drives
- Analog phase lock loop for reliable read operations at both single and double densities
- Write precompensation logic to insure media interchange compatibility
- Crystal controller write circuitry.

## Power requirements

8 v @ 1.22 typical (1.52 case)  
+16 v @ 30 ma typical (65 ma worst case)  
-16 v @ 20 ma typical (40 ma worst case)  
Jumper allows 2716 EPROM in special limited function applications.

Microprocessor capable of executing commands both from firmware (standard operation) and from RAM (specialized media, etc.)

## Software Options

CPM drivers available which connect the controller to any CP/M\*\* system  
CP/M\*\* 2.2 operating systems available  
M/OS (UNIX®\*) operating system available  
With CP/M or M/OS the controller will run any standard software

## Communications

An imbedded microprocessor enables the user to easily communicate with this intelligent device. All low level disk drive routines are resident on the controller itself (with the exception of format). These include:  
read (drive, sector, track)  
write (drive, sector, track)  
read (track, drive)  
write (track, drive, sector)  
list address)  
set DMA address  
sense drive characteristics  
set channel address  
branch in channel  
halt

Variable sector lengths are available. On Morrow Designs system products, 1024 (8") and 512 (5 1/4") are standard. This is to maximize the capacities available on current drive units but may be varied by independent system integrators when desired.

The DJDMA has been designed for expansion. One to eight drives can be attached directly and controlled. Double sided drives can be accomodated as well as 96 track per inch drives.

This controller has no peer today in the S-100 bus market. Examples of compatible drives are:

Shugart	Tandon	Qume
400	Slimline	Datatrak
450	TM848-1	
410	TM848-2	
460		
800		
850		
801		
851		

and many others

## Systems interfaced:

1. North Star
2. Cromemco
3. Vector Graphics
4. Dynabyte
5. Micromation
6. Exidy
7. Imsai
8. Sol
9. California Computer
10. Godbout
11. Ithaca Intersystems

Look to Morrow for answers!